MASTER OF SCIENCE
IN
APPLIED MATHEMATICS

AGGREGATE MODELS FOR TARGET ACQUISITION IN URBAN TERRAIN

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High-resolution combat simulations that model urban combat currently use computationally expensive algorithms to represent urban target acquisition at the entity level. While this may be suitable for small-scale urban combat scenarios, simulation run time can become unacceptably long for larger scenarios. Consequently, there is a need for models that can lend insight into target acquisition in urban terrain for large-scale scenarios in an acceptable length of time.

This research develops urban target acquisition models that can be substituted for existing physics-based or computationally expensive combat simulation algorithms, and result in faster simulation run time with an acceptable loss of aggregate simulation accuracy. Specifically, this research explores: 1) the adaptability of probability of line of sight estimates to urban terrain; 2) how cumulative distribution functions can be used to model the outcomes when a set of sensors is employed against a set of targets; 3) uses for Markov Chains and Event Graphs to model the transition of a target among acquisition states; and 4) how a system of differential equations may be used to model the aggregate flow of targets from one acquisition state to another.

KEYWORDS: Probability of Line of Sight, Line of Sight, Urban Target Acquisition, Cumulative Distribution Functions, Markov Chains, Systems of Differential Equations